Cleaning & Inspection

Coal powered Power Plant (Malaysia)

- Heater Units
Adamasia, a SWIS exclusive partner, recently completed an inspection of four heater units at a coal fired power plant in Malaysia. The four units consisted of 9,114 U-tubes.

- Customer awarded Adamasia a contract to open, clean and inspect four heater units at the power plant.

- The client chose Adamasia for the work due to their prior experience with APR, the capabilities of the Sonic V device, and the ability of this technology to easily detect flaws in U-tubes.
Cleaning method

Cleaning Heater units in coal fired power plants is particularly challenging because the tubes have a U-bend and contain thick residue that is difficult to get to. Since APR inspections require clean tubes for accurate analysis, Adamasia used a specialized cleaning technique, to effectively prepare the units for inspection.

To ensure the best possible results for their client, Adamasia established and followed a detailed cleaning and inspection process (next slide). The outcome was very effective and we recommend this procedure for all coal fired power plants.
Heater Cleaning and Inspection process

1. Opening manhole
2. Removal of plates on tube sheet
3. Clean tubes using Rotary Brush or Hydro jetting
4. Blow dry with air using special air gun
5. Preliminary APR sampling inspection to determine tubes are clean
6. 100% inspection of all tubes using APR
7. Verify defects with Boroscope
8. Plugging
9. Final reporting
10. If necessary:
    - Secondary cleaning of tubes which are (partially) blocked
    - Re-inspect tubes that required secondary cleaning
## Summary Of Inspection Results

<table>
<thead>
<tr>
<th></th>
<th>Heater Unit 3</th>
<th>Heater Unit 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tube sizes</td>
<td>OD 19.05 mm x WT 1.5 mm</td>
<td>OD 15.88 mm x WT 1.8 mm</td>
</tr>
<tr>
<td>Material</td>
<td>ASTM A556M Gr.B2</td>
<td>JIS SGV480</td>
</tr>
<tr>
<td>Tube Length</td>
<td>23 m</td>
<td>17.42 m</td>
</tr>
<tr>
<td># of Tubes</td>
<td>1,206 U-tubes (1,088 tubes tested)</td>
<td>2,692 U-tubes (2,621 tubes tested)</td>
</tr>
<tr>
<td>Defects Found</td>
<td>• Total Blockage: 534</td>
<td>• Total Blockage: 247</td>
</tr>
<tr>
<td></td>
<td>• Wall Loss 20%-40%: 162</td>
<td>• Wall Loss 20%-40%: 65</td>
</tr>
<tr>
<td></td>
<td>• Wall Loss 41%-60: 2</td>
<td>• Wall Loss 41%-60: 1</td>
</tr>
</tbody>
</table>
## Summary Of Inspection Results

<table>
<thead>
<tr>
<th></th>
<th>Heater Unit 6</th>
<th>Heater Unit 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tube sizes</td>
<td>OD 15.88 mm x WT 1.8 mm</td>
<td>OD 15.88 mm x WT 1.8 mm</td>
</tr>
<tr>
<td>Tube Length</td>
<td>20 m</td>
<td>17.42 m</td>
</tr>
<tr>
<td># of Tubes</td>
<td>2,608 U-tubes (2,561 tubes tested)</td>
<td>2,608 U-tubes (2,600 tubes tested)</td>
</tr>
<tr>
<td>Defects Found</td>
<td>• Total Blockage: 776</td>
<td>• Total Blockage: 0</td>
</tr>
<tr>
<td></td>
<td>• Wall Loss 20%-40%: 615</td>
<td>• Wall Loss 20%-40%: 389</td>
</tr>
<tr>
<td></td>
<td>• Wall Loss 41%-60: 10</td>
<td>• Wall Loss 41%-60: 15</td>
</tr>
</tbody>
</table>
Verification with Boroscope

HP 6 Heater – 45% wall loss

HP 6 Heater – 45% wall loss

HP 5 Heater – 50% wall loss
Outcome

- Adamasia carefully and thoroughly cleaned every tube prior to inspection with the Sonic V.

- Every defect in post inspection report was verified with a Boroscope and located at the precise location detected by APR.

- Accuracy in APR testing requires clean tubes and careful analysis. The Sonic V proved to be extremely accurate in great part because of the effective cleaning techniques that Adamasia used.

- Following report review, the plant owner decided to plug every tube with inner diameter wall loss greater than 40%.

- With inspection speeds of 250 tubes an hour, the Sonic V proved to be significantly faster than other techniques despite U-bend tubes that are 23 meters long.

- Following Adamasia’s report on the heater units, plant ownership requested that the Sonic V be used on all future inspections.

- Adamasia now recommends that clients combine Sonic V testing with the cleaning technique they utilized during this inspection for all similar equipment and applications.
Pictures

(Image of Sludge Removed from Heater Unit 5 & 6)

(Image of Black Thick Sludge Removed from Heater Unit 7)
Pictures

(Sonic V)

(Tube sheet after cleaning)
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